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Marine Casualty Investigations

Enquêtes sur les accidents maritimes

Investigation Report to the Minister pursuant to sections 542 or 545 of the Canada Shipping Act

Rapport d'investigation au Ministre conformément aux articles 542 ou 545 de la Loi sur la marine marchande du Canada

Canada

Ce rapport est aussi disponible en français.

REPORT OF INVESTIGATION OF THE CIRCUMSTANCES SURROUNDING THE GROUNDING OF THE BERMUDIAN VESSEL "CAST OTTER" IN THE ST. LAWRENCE RIVER NEAR CAP GRIBANE, QUEBEC ON JUNE 9, 1987.

REPORT No. 496

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REPORT OF INVESTIGATION OF THE CIRCUMSTANCES SURROUNDING THE GROUNDING OF THE BERMUDIAN VESSEL "CAST OTTER" IN THE ST. LAWRENCE RIVER NEAR CAP GRIBANE QUEBEC ON JUNE 9, 1987.

Particulars of Vessel

Name	"CAST OTTER"
Official Number	702161
Port of Registry	Hamilton, Bermuda
Flag	Bermudian
Call Sign	VSBB4
Gross Tonnage	40,293 t
Net Tonnage	28,623 t
Length	234.63 m
Breadth	32.26 m
Draught (at time of incident)	Fwd: 8.5 m Aft: 9.25 m
Type	Container/Bulk Carrier
Built	1982, Ulsan, Korea Hyundai Heavy Industries
Propulsion	One bridge controlled 4 cylinder Sulzer 2SA diesel engine driving a single non-controllable pitch propeller, 13,600 b.h.p. (10004 kW)
Cargo	15,240 t titanium slag and containers
Crew	22 persons
Passengers	10 persons
Owner	Conbulkships (3) (1983) Ltd. Hamilton, Bermuda
Local Agents	Cast North American (1983) Inc., Montreal, Canada

Description of Vessel

The "CAST OTTER" was built specially for transporting containers and bulk cargo.

The engines, the accommodation and the bridge are located aft. She has seven holds and her hull is reinforced for the carriage of heavy cargoes and to withstand the load imparted by the unequal distribution of weight in the holds. She is also reinforced for navigation in ice.

The engine-room is highly automated and the engineers maintain a continual surveillance only when the vessel is in restricted waters.

Note: All times in this report are expressed in Eastern Daylight Saving Time (UTC minus 4 hours).

Background

On June 9, 1987, the Bermudian vessel "CAST OTTER" having left Sorel in Quebec was headed for Port-Cartier, also in Quebec, in order to finish loading before crossing the Atlantic.

She entered the North Channel, below Île d'Orléans, then suffered an electrical failure. The emergency generator did not start and despite the efforts of the master and the crew to reduce the speed of the vessel, she grounded near Cap Gribane on the North Shore of the St. Lawrence River.

The tide was falling and it was only on the rising tide that she was able to be refloated with the help of tugs. Her hull was not holed nor was there pollution.

Narrative

The "CAST OTTER", registered in Hamilton, Bermuda, had left Sorel at the start of the day on June 9, 1987 with 15,240 t of titanium slag and some containers on board.

That same day, at 1844, she passed Cap Brûlé below Île d'Orléans bound for Port-Cartier where she was to finish loading before beginning the crossing of the North Atlantic. The master, the OOW, the pilot and the helmsman were on the bridge.

At 1845, the course was changed to steer 034°T. All was normal on board. The vessel was proceeding at approximately fifteen knots over the ground. Suddenly, at approximately 1851, there was an electrical failure on the bridge. All the

alarms sounded at the same time and it appeared that even though the main steering position had been changed over to the secondary, the steering gear was no longer functioning.

The vessel slowly turned to port and although the angle indicator showed 5° starboard, it was obvious that the "CAST OTTER" would leave the buoyed channel. The master stopped the main engine and attempted to put it astern. At the same time, he ordered the OOW to go forward and drop the anchors.

The main engine was turning astern on starting air but did not start. The master pressed the emergency start-up button and tried, again unsuccessfully, to start the main engine astern.

The chief engineer was in the alleyways when he noticed that the lights were going out. Because the main engine was still functioning, he did not immediately realize that there was an electrical failure. He believed the watch engineer was testing the electrical circuits.

After a few seconds, as the lights did not come back on, he ran to the control-room where he found the watch engineer speaking on the telephone to the wheel-house. It was noted that the console was lit by the battery system, that even though the main engine had been stopped it was still turning ahead, that the master was trying to put the vessel astern and that the emergency start-up button was being depressed. It was also noted that the starting air pressure was rapidly falling.

He then changed the remote bridge control to engine-room control by using the lever for this purpose located on the console and he too tried in vain to start the main engine astern. Not succeeding, the watch engineer was ordered to go to the manual control position located near the engine itself to try to start the engine from there, and not to forget to open the reserve compressed air receiver on the way.

Meanwhile, the officer who had left to drop the anchors arrived at the windlass accompanied by the sailor on duty and they both dropped the anchors. A length of chain was run out, then the brake bands were tightened up on their drums. The vessel still had a lot of headway and the tension on the chains was such that chain continued to pay out. The heat created by the friction on the brake linings was so high that they caught fire.

In the engine-room, the engineer arrived at the manual control position. He actuated the levers and the main engine started astern without any difficulty.

At that moment, the master rang stop engines on the telegraph because the vessel had just gone aground in approximate position 47°08.5'N by 070°41.2'W, on an approximate heading of 260°T. The gyro-compass indicator still showed 033°G because its electrical supply and been interrupted. It was approximately 1855.

The anchors were heaved on by the windlass but the vessel did not move. The main engine was put at slow speed astern then grinding sounds were heard forward. The starboard anchor chain ran under the vessel and it was feared that it was wedged between the bottom of the vessel and the rock. So as not to damage the bottom plating, all attempts at refloating the vessel were postponed until the next tide.

At approximately 1910, tugs were requested by radio. At approximately the same time, power was re-established. Soundings taken around the vessel indicated that her forward end was aground up to No. 2 hold. The forward draught had been 8.5 m before the accident; it was now only 4.5 m. No tanks appeared to be holed. As the tide fell, the aft section of the vessel got closer to the bank. The "CAST OTTER" listed slightly to port.

With the rising tide and the help of two tugs, the vessel was refloated at 0057 June 10, 1987. The vessel was slowly brought to an anchorage located slightly further East and she was anchored at 0248 on June 10 in order to check the state of her hull, the alignment of the propulsion shaft and the deflection of the crank shaft.

At 0730 on June 10, 1987, the Canadian Coast Guard, through the Ship Safety Branch, granted the "CAST OTTER" permission to proceed to Port Cartier where a marine surveyor would inspect the vessel.

There was no injury or pollution caused by this grounding.

Analysis

1. Weather Conditions

At the time of the accident, the wind was from the North-East at 5-10 knots, visibility was six miles and there was a fine drizzle.

2. Speed of the vessel

With the ebb tide the "CAST OTTER" was proceeding at approximately 15 knots over the ground. The ebb

currents in this part of the river reach 2.5 knots according to the indications on chart No. 1232 published by the Canadian Hydrographic Service. The maximum speed of the vessel is rated at 14.5 knots.

3. Description and function of electrical system

The vessel is fitted with three main generators of 570 kW, 440 volts each and one emergency generator.

One of the main generators has enough capacity to supply the vessel's electrical requirement when on passage but, when she is in restricted waters, two generators are kept in parallel on the main electrical distribution panel for a better protection in case of a breakdown. In fact there were two generators in parallel at the time of the accident.

The emergency generator supplies the main navigation equipment and that necessary for the basic operation of the vessel, i.e. the control consoles, radios, radars, engine-room ventilators, emergency fire pump and the steering gear starboard unit, etc.

The electrical current is distributed to the various pieces of equipment from the emergency electrical distribution panel even if the emergency generator is not functioning. A switch on the main distribution panel supplies the emergency distribution panel. In the event of an electrical failure the emergency generator will automatically start-up, the main emergency circuit-breaker will close and re-establish the electrical current to this basic equipment.

4. Cause of the electrical failure

On the emergency electrical distribution panel, among other protection devices, there is a time delay relay marked K-9 whose function it is to prevent the emergency generator from coming in to parallel with one of the main generators, which could cause serious damage.

It was precisely this relay which became defective and opened the main breaker on the emergency electrical distribution panel. This caused a failure of all the electrical circuits normally supplied by this panel.

The emergency generator did not start because the two main generators were still functioning and supplying the main electrical distribution panel. There was therefore no indication of an electrical current failure which

otherwise would have started the emergency generator automatically.

5. Antecedents and consequences

Nobody on board the vessel had ever experienced such a failure. The defective part was made by a well-known manufacturer and even though these relays have been known to fail in the past, they are regarded as dependable.

Because all the instruments on the wheel-house console together with the navigation aids stopped functioning, the master believed that there had been a failure of the main generators and he expected the emergency generator to start. As this did not happen and he had the impression that the steering gear was no longer functioning he tried to go astern on the main engine to reduce the vessel's headway.

6. The steering gear and its functioning

The hydro-electric four cylinder steering gear of the "CAST OTTER" was made by Mitsubishi Rapson Slide.

The electrical supply system of the steering gear is designed so that if there is a failure in one of the main generators, the starboard motor unit of the steering gear will be supplied by the emergency generator.

The starboard motor unit has two operating speeds. It works at normal speed when it is fed by the main distribution system and at lower speed when it is fed by the emergency distribution system so as not to overload the emergency generator. In these conditions, the movement of the rudder is also limited to 15° on each side.

At the time of the accident, the two motor units of the steering gear were functioning. After the emergency electrical distribution panel failure, at least the port steering gear unit was still functioning because the electricity supply from the main distribution panel was still available.

In the heat of the moment, nobody realized this fact especially since in the wheel-house, the rudder angle indicator was not functioning and the personnel believed that there was a general electrical failure.

In reality, it was still possible to steer the vessel because the main engine was still running and the steering gear was functioning even though the rudder angle indicator had failed.

7. Emergency start-up and description of the control system

After one or two unsuccessful attempts to start the main engine astern, the master pressed the emergency start button.

This system starts the main engine by circumventing the logical protection system of the engine. In the event that the engine had automatically stopped because of some failure, for example a break in the cooling system, the master could, by pressing this button, still start the engine in order to avoid a casualty. The emergency button also circumvents the logical sequence of normal starting, permits the unrestricted use of starting air and admits more fuel into the combustion chambers (cylinders).

The engine still did not start when the emergency button was pressed. At this moment, the chief engineer took over and also tried unsuccessfully to start the engine astern.

The remote control of the engine in the control room is pneumatic while the one in the wheel-house is electric.

8. Pressure of starting air

The starting air pressure is normally maintained at 2600 kPa (26 bars). When the chief engineer took the controls, the pressure had already fallen to approximately 1000 kPa (10 bars). Only one compressed air receiver was open, the other was closed and was filled to its normal operating pressure. It is a regular practice on many vessels to have one such receiver isolated from the others in order to have a reserve in case of a break which could cause a total loss of the compressed air.

At the time of the failure, one of the air compressors was in automatic mode whereas the second was in manual mode.

Each time the chief engineer tried to start the main engine astern, it turned astern on the starting air but did not actually start. As soon as the start-up handles were let go, the engine stopped and started turning at

30 to 45 r.p.m. ahead driven by the propeller, indicating that the vessel still had a lot of headway.

To start the engine, the minimum starting air pressure should be 12-13 bars and the engine must turn at least at 20 r.p.m.

9. Fuel supply

As he was trying to start the main engine astern, the chief engineer looked at the position indicator of the fuel pump rack. It showed 7 on the maximum scale of 8. It should be noted that this indicator functions by electricity and that nobody checked the engine itself for the real position of the rack.

10. Difficulties in starting the main engine

The vessel is propelled by a large motor whose maximum speed is 90 r.p.m. It is directly connected to the propeller shaft with no gear box. It drives a non-controllable pitch propeller. The direction of the main engine's rotation must then be reversed to go astern.

At the time of the electrical failure, the vessel was proceeding at approximately 15 knots, over the ground, if the speed of the ebb tide is taken into account. When the engine was stopped after the electrical failure, the pressure of the water on the blades of the propeller caused by the headway of the vessel was sufficient to make the engine turn at approximately 40 r.p.m. ahead. The speed of the engine before the electrical failure was approximately 80 r.p.m. Normal cruising speed is 86-87 r.p.m.

Sufficient turning speed astern to permit the engine to start would require good starting air pressure. During the first attempts at starting the engine astern, the starting air pressure was normal, but it had already been reduced to 10 bars where the chief engineer took over in the control room. When the watch engineer succeeded in starting the engine, the starting air pressure was approximately 11-12 bars. This rise was caused by the fact that the engineer had just opened the second compressed air reservoir.

11. Probable cause of the main engine's refusal to start

At the master's first attempt to start the main engine astern, the starting air pressure was sufficient to ensure a normal start, yet the engine did not respond.

At that time, the water pressure on the blades of the propeller was strong and it is conceivable that the quantity of fuel necessary to start the engine astern should have been at its maximum because the engine should have started in overload.

The master tried to start the engine in the normal way, that is with the logical system of protection in operation. With this system, the quantity of fuel admitted is limited as is the starting air. Once the engine is started, acceleration is gradual. If the engine does not start at the first attempt, the starting operation is repeated three times, then an alarm sounds which indicates that the engine refuses to start. The whole starting sequence then stops.

The emergency starting button was finally pressed in order to circumvent the logical protection system, but the vessel was still moving ahead quite quickly and the pressure exerted by the water on the propeller blades was turning the propeller, and the engine, ahead. To start the engine astern under these circumstances, the master would have had to advance the accelerator lever to the maximum.

When the chief engineer took the controls, the starting air pressure was already insufficient for the starting, even in normal conditions.

However, the watch engineer, after having opened the second compressed air receiver, succeeded in starting the engine almost at the same time as the vessel grounded.

12. Stopping distance of the vessel

Abeam of Cap Gribane, the shore is only one-quarter mile from the buoyed channel. The distance covered by the vessel in four minutes between the time of the failure and the time the vessel grounded is approximately one nautical mile. According to information obtained aboard the distance necessary for stopping such a vessel, when she is proceeding at her maximum speed, is close to 2.7 nautical miles.

After the accident, attempts were made by the crew and in the presence of experts from the Bureau Veritas Classification Society to check the ability of the vessel to stop in an emergency. The results were satisfactory.

13. Classification and maintenance of the vessel

All the inspection certificates of the vessel were valid.

The vessel's owners apply a very strict preventive maintenance programme. The verification and testing of the protection devices of the electrical system are done regularly and include megohm tests of the circuits.

The engine-room and the whole vessel are very clean and well maintained.

14. Safety Equipment

No safety equipment was used during this grounding.

The VHF/RT was used to report the accident and to request the assistance of tugs.

In the event of a total electrical failure, the radio-telephones function on a battery powered 24 volt system.

15. Damage sustained by the hull of the vessel

Shortly after the accident, the "CAST OTTER" entered dry-dock. At this time, two indentations were observed forward under the hull of the vessel. One was visibly caused by the anchor chain, the other one by an unidentified object, perhaps a rock. No perforations were discovered.

16. Qualifications and experience of personnel

The master of the "CAST OTTER" holds a British Certificate of Competency as Master Mariner issued in 1980. He has occupied this position since March 1987 and has worked as master since 1984. He has twenty years experience at sea.

The chief officer holds a British Certificate of Competency as Master Mariner. He has been working on this vessel since August 1986 and has acted as chief officer since 1979. He has twenty-three years experience at sea.

The chief engineer holds a British Certificate of Competency as a First Class Engineer issued in 1979. He has been working on this vessel since February 1987 and, since 1983, he has acted as chief engineer on the "CAST OTTER" and on other similar vessels. He has sixteen

years experience at sea.

The watch engineer holds an Irish Certificate of Competency as a Second Class Engineer issued in 1984. He has been working on this vessel for 4½ months and, since 1983, has worked on other similar vessels. He has acted as a marine engineer since 1980.

The electrician holds a British Certificate of Competency for the maintenance of radar equipment on merchant ships, issued in 1985. He has worked on the "CAST OTTER" as an electrician and a radio operator since December 1986.

Findings

On June 9, 1987, the Bermudian vessel "CAST OTTER" grounded near Cap Gribane on the St. Lawrence River below Île d'Orléans after an electrical failure. The casualty caused neither injuries nor pollution and the vessel sustained only minor damage to the forward section.

It would appear that the following factors contributed to the grounding:

- an electrical failure was caused by a defective time delay relay which was part of the emergency electrical distribution panel;
- this failure caused the navigation instruments to become inoperative along with the rudder angle indicator; and
- the vessel, carried by the ebb tide, was proceeding at approximately fifteen knots over the ground and was incapable of stopping in time to avoid grounding even though both anchors had been let go.

Other Findings

After the electrical failure, the main engine continued running ahead and evidently, the steering gear also continued functioning.

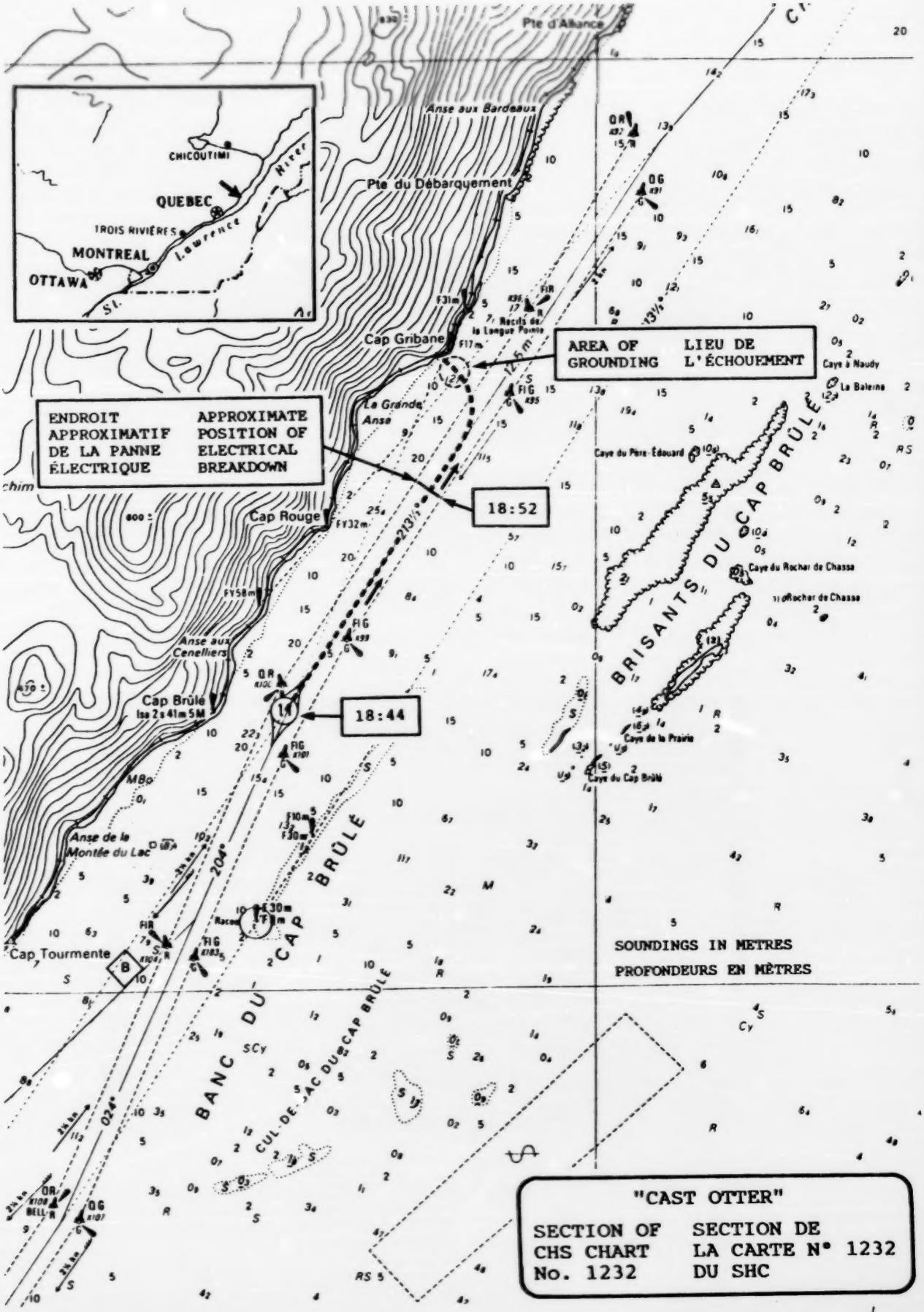
It was possible to continue steering the vessel during the failure even though this was not evident to the navigating personnel.

Because of the vessel's headway, the water exerted pressure on the blades of her propeller which caused the propeller, and the engine, to continue turning ahead

even though the engine had been stopped.

In these particular operating conditions the method used to start the engine from the remote control positions was unsuccessful.

OTTAWA, ONTARIO
MAY 1988.



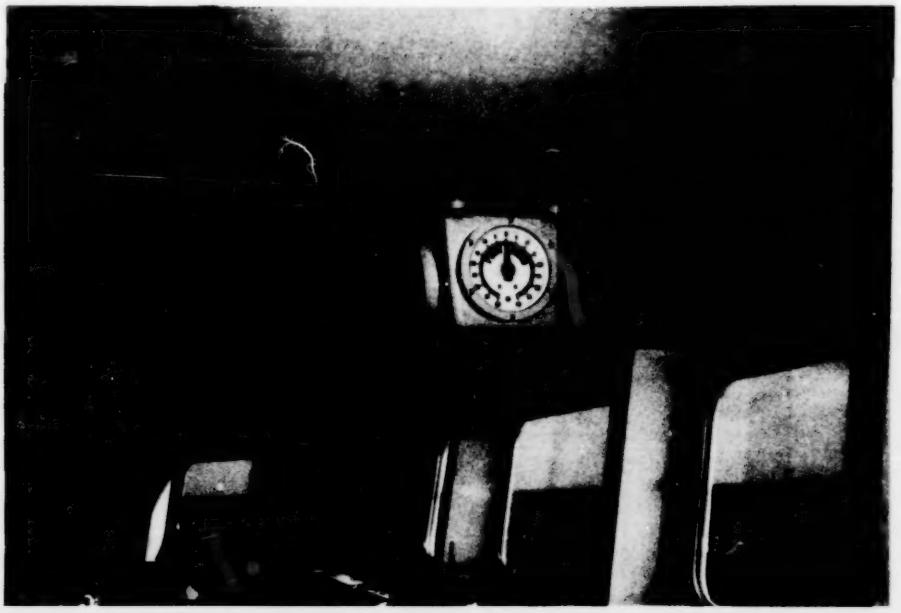
"CAST OTTER"

SECTION OF CHS CHART No. 1232

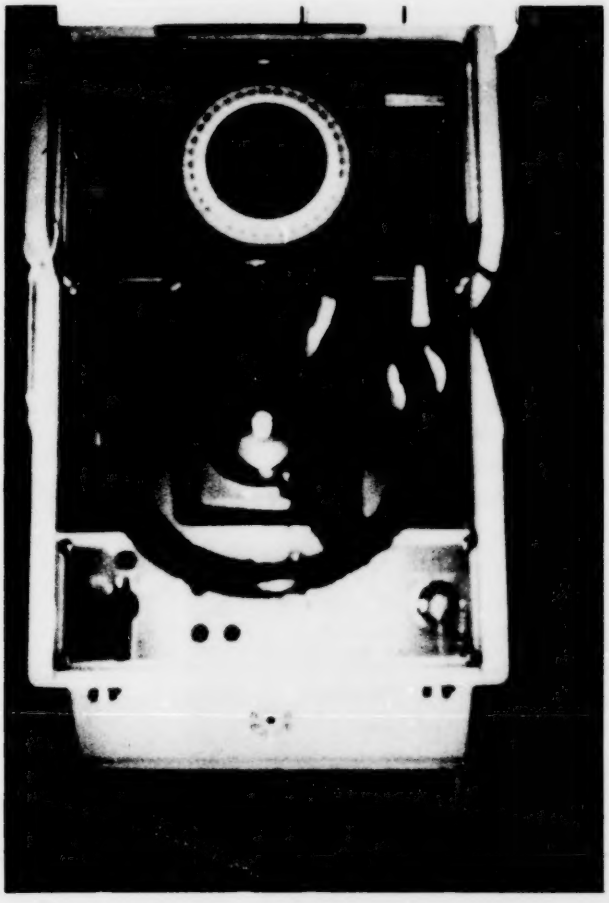
SECTION DE LA CARTE N° 1232 DU SHC

"CAST OTTER" at anchor at Port-Cartier (Q.C.).
"CAST OTTER" à l'ancre à Port-Cartier (Q.C.).

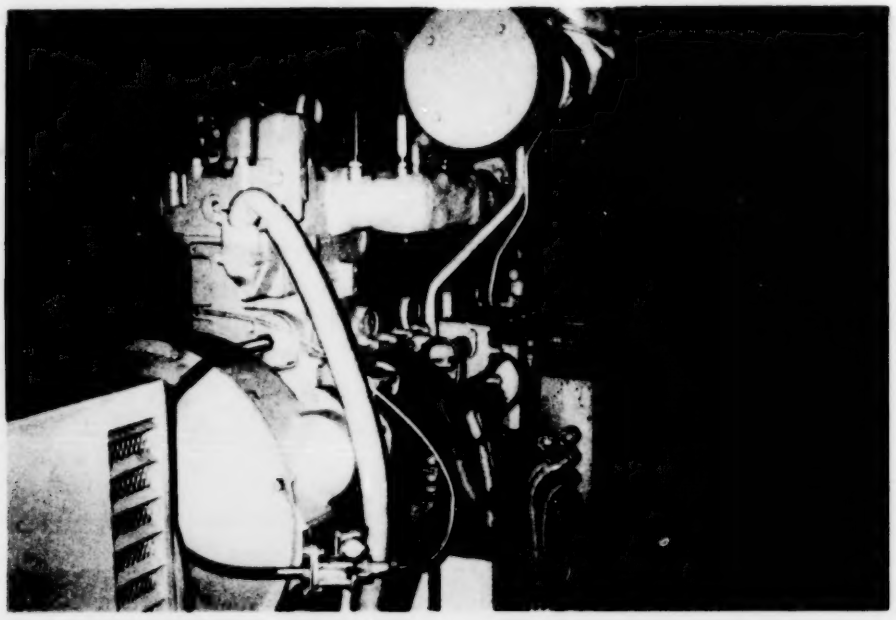
"CAST OTTER" - wheel-house interior.
Intérieur de la timonerie du "CAST OTTER".



Rudder angle indicator.
Indicateur d'angle de barre.

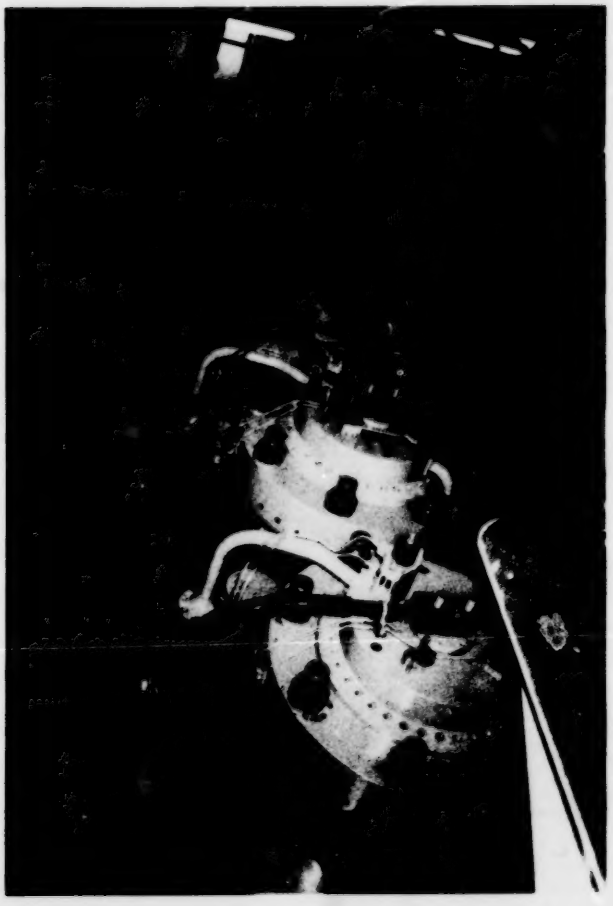


Steering console.
Poste de barre.



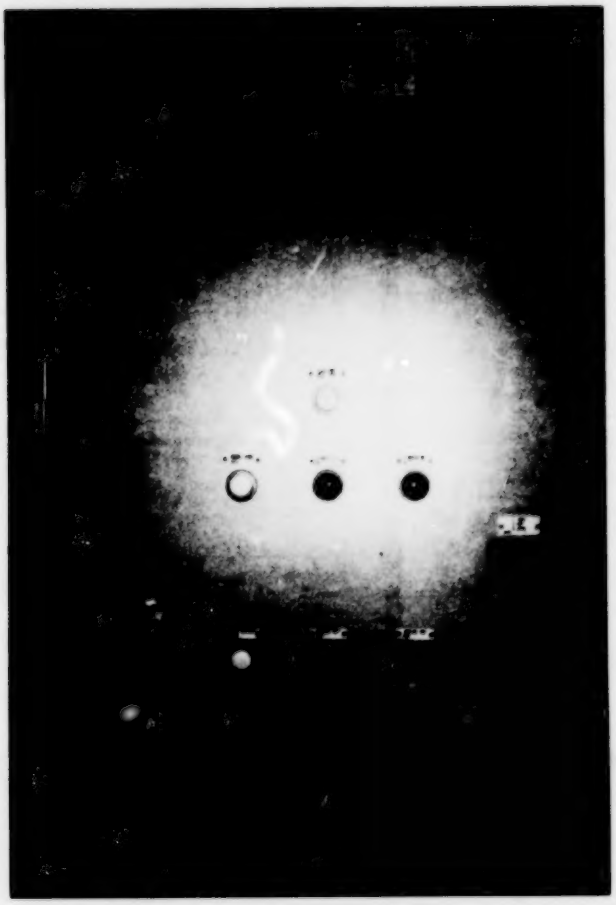
Emergency generator.

Génératrice de secours.



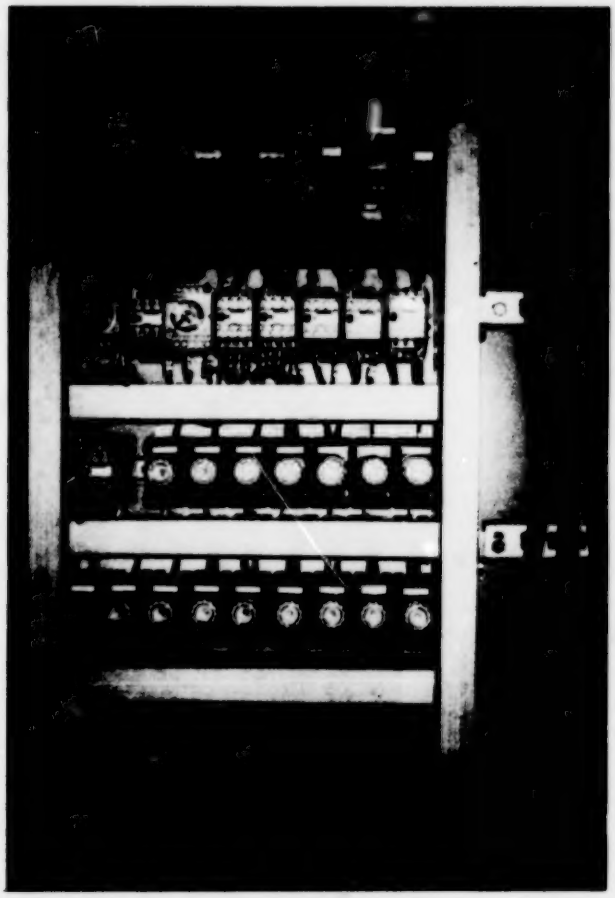
Main engine -
"CAST OTTER".

Machine principale
du "CAST OTTER".



Emergency electrical distribution panel.

Tableau électrique de secours.



Some components of the emergency electrical distribution panel.

Quelques composantes du tableau électrique de secours.